2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This section of the EA provides a detailed description of the Preferred Alternative (the proposed route through Stellwagen Bank NMS), the Northern Alternative route, and the No Action Alternative.

2.1 ALTERNATIVE SELECTION CRITERIA

The applicant and NOAA applied the following selection criteria to determine the range of reasonable alternative routes that meet the purpose of the project and fulfill identified needs.

- **Potential cable routes must be economically viable.** To meet the project's stated purpose, installation of cable along the route must not be prohibitively expensive or time-consuming.
- **Potential cable routes must be technically feasible.** Technical feasibility refers to the ability to fully exploit sea plow technology to meet designated fault tolerances. High confidence that potential threats to the integrity of the cable are minimized must be ensured.
- **Cable must be buried along the entire length of the segment within the Stellwagen Bank NMS, to the extent that doing so proves technically feasible.** If the cable wire were unburied, that circumstance would increase potential hazards and effects on commercial fisheries, benthic communities, and potentially, marine mammals. Damage to fishing gear is also more likely when a cable is unburied. In turn, increased rates of cable failure could be expected.
- **Cable routes should avoid traversing rock, to the extent that is technically feasible.** Traversing rock would require blasting, which is not under consideration, or laying the cable on the sea bed. For that reason, both alternative routes are designed to minimize or avoid rock crossings.
- **Routes should avoid sensitive environmental resource areas, insofar as possible.** Both alternative routes are designed to avoid sensitive environmental resources (for example, valuable benthic communities) to the greatest extent possible.
- **Potential routes should avoid, when possible, dredge spoil sites, abandoned cables (if any), military disposal sites, and other disturbed areas.** Burial installation of cable through any such sites could disturb concentrations of hazardous or explosive materials and contribute to contamination of both the water column and sediment.

2.2 ALTERNATIVES CONSIDERED

Through an application of the selection criteria discussed above, the following alternatives are considered in this EA.

- **Preferred Alterative:** A cable route that traverses approximately 19.49 km of Stellwagen Bank NMS
- **Northern Alternative:** A route that turns to the north before reaching Stellwagen Bank NMS, circumventing the sanctuary
- **No Action Alternative:** No cable would be installed

2.2.1 Preferred Alternative

The applicant's Preferred Alternative is for a section of the overall Hibernia Project to traverse the Stellwagen Bank NMS. From Halifax, Nova Scotia, Canada, the proposed cable route enters U.S. territorial waters at the Hague Line, crosses Wilkinson Basin, and enters the Stellwagen Bank NMS near the northeast corner of the sanctuary. The cable route then traverses approximately 19.49 km of the sanctuary, along its northern boundary, and leaves the sanctuary near its northwest corner, off Rockport, MA (see Figure ES-1). From that point, the cable continues in a westerly direction to the cable-landing site at Lynn Beach, MA. Lynn Beach was identified as the landing site because of its proximity to Boston and its favorable shoreline conditions, and because the cable route to that landing site would avoid shipping lanes and dredge channels associated with Boston Harbor. The preferred cable route is intended to maximize use of state-of-the-art cable installation technology to maximize the integrity and safety of the installed cable, while minimizing the potential environmental effects of the installed cable.

Cable Route

The length of the Preferred Alternative route from the point at which it diverges to the point at which it rejoins the Northern Alternative would be approximately 115.3 km (see Figure ES-1) (Seafloor Surveys International, Inc. 1999). This would include approximately 19.49 km of the Stellwagen Bank NMS. The entire cable segment within Stellwagen Bank NMS would be buried, thereby reducing potential effects on fishing vessels and marine mammals. The applicant believes that the Preferred Alternative route is the most economically efficient routing. The Preferred Alternative route has been pre-surveyed by side-scan sonar and subbottom profiling to identify sediment types along the route and to confirm the absence of any conditions or obstacles that might affect burial of the cable. In addition, core samples were taken to confirm the sea bed sediment types present (360networks, inc. 2000a). The route has been designed to avoid potential areas of environmental sensitivity, landslide vulnerability, and areas of high importance for commercial fisheries.

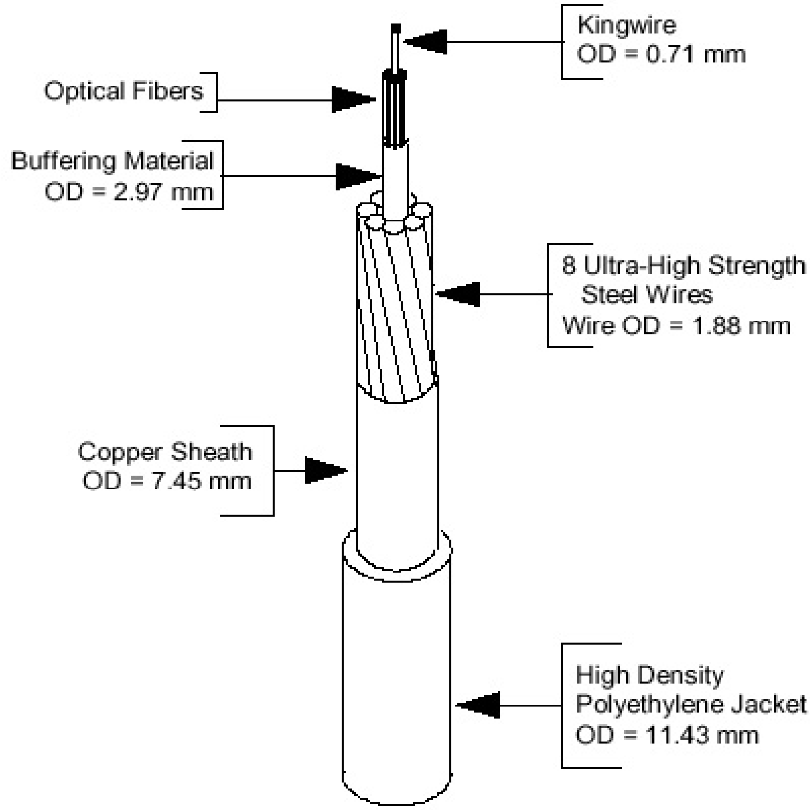
Cable Characteristics

The undersea fiber-optic cable would consist of a 2-inch-diameter cable that has a core of eight glass fibers and an external protective coating of steel cables. An inner polyethylene sheathing surrounds the fibers; an outer layer of armor wires and cotton and pine tar protects against ingress of water (Earth Tech 1999). The cable does not contain any liquids or other material that would leak out of the protective coating in the event of a break. Figure 2-1 displays a cross-section of the proposed cable and sheathing.

Fiber-optic cable networks require the installation of repeaters to maintain the strength and integrity of transmission. A typical repeater consists of a thickening of the cable, one foot in diameter and five feet in length, inside of which electrical components are located. Repeaters are installed at intervals of approximately 50 km along the entire length of the project.

The applicant's surveys indicate that the closest repeater to the west of the Stellwagen Bank NMS would be 17.78 km from the sanctuary and that no repeaters would be installed within the 19.49 km span through the sanctuary (360networks, inc. 2000a). Appendix B presents additional technical specifications for the proposed cable.

Figure 2-1: Cable Cross-Section (360networks, inc. 2000a)



Cable Installation

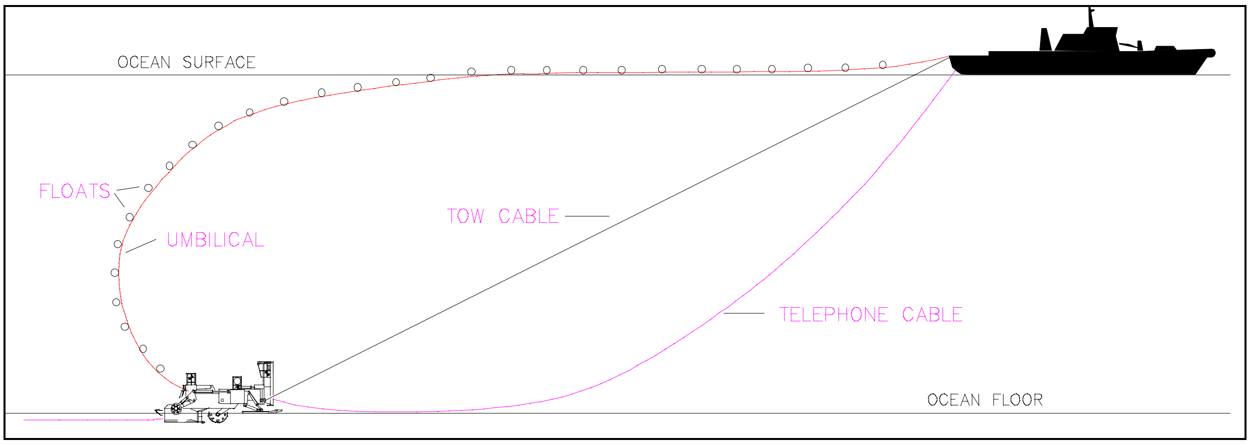
Before the cable is installed, a grapnel drag would be performed along the cable route to determine the presence of any unknown (abandoned) cables or any fishing gear or other debris. The depth of the prongs on the grapnel is approximately 40 centimeters (cm). The width of the grapnel spear (the portion that penetrates the sea bed) is 6 inches (in) across. Any obstacles encountered would be severed after appropriate confirmation is made that the cable, rope, wire, or other obstruction has been abandoned. The grapnel drag would be performed along the approved cable route only. A database of known cables in the world (including known abandoned cables) will be used to identify all existing cables along the route. That database is maintained to identify cables along a prospective cable route and is updated regularly with information from parties involved in the submarine cable industry. The route survey also is able to detect cables along the route.

Two 6-inch steel conduits would be installed beneath the nearshore areas of Nahant Bay to the 5 m water depth. Hibernia initially would occupy one of those conduits, and the second conduit would accommodate a future, as yet unidentified, project. The directional drill from shore would allow the cable to be installed within the conduit from the landing site to the 5 m water depth without disturbance to the sea bed. In offshore areas, the cable would be buried approximately 1.5 m beneath the ocean bottom from the end of the conduit to the 1,500 m depth level, which occurs at the continental shelf in international waters. Cable installation in depths of more than 1,500 m would be accomplished by laying the cable unburied along the ocean bottom.

Although the cable installation proceeds at a slow rate, the time required for installation of the cable in the sanctuary would be expected to be minimal. If the cable ship moves at approximately 0.5 to 1.0 nautical mile (knot) (a knot is slightly more than 1 mile per hour) and the proposed length of the route in the sanctuary is approximately 19.49 km, it is expected that the cable could be installed through the sanctuary in less than two days. Further, cable installation activities would be coordinated with all interested parties to ensure minimal effects during the installation phase (Earth Tech 1999).

To minimize potential effects to navigation, the fishing industry, other maritime activities, and environmental resources, the undersea cable would be installed approximately 1.5 m beneath the sea bed. To install the cable beneath the sea bed, the applicant would use the "Sea Plow VII," an unmanned towed vehicle that is controlled from a cable ship. The Sea Plow VII operates on the ocean floor to bury telephone cables, small flexible pipe, and associated line accessories, such as repeaters and splice boxes, to depths of as much as 1,500 m. Figure 2-2 illustrates a typical burial configuration that uses the Sea Plow VII burial vehicle towed by a cable ship.

Figure 2-2: Sea Plow VII Burial Plowing Configuration (Earth Tech 1999)



State-of-the-art navigation technology enables the plow to follow the cable route to an extremely high degree of accuracy. The plow process would displace a shallow wedge of the sea bed temporarily (approximately 1.0 m wide by 1.5 m deep) and install the cable within the trench. The displaced soil then would be returned to its original location. The minimal amount of soil disturbance required for installation and the immediate restoration of the disturbed area would limit effects on the marine environment. The process does not involve activities typically associated with dredging, such as suspension, side-casting, or permanent removal of sediment (Earth Tech 1999).

Sea Plow VII is towed with a steel tow wire by the support ship from which it is launched. A traction winch is used to control payout and retrieval, as well as tension on the tow wire. The Sea Plow VII vehicle is controlled from a console located in the control van on deck, to which the vehicle is connected by a fiber-optic umbilical cable. Launching is accomplished by use of a hydraulically operated A-frame on the stern of the support ship. Payout and retrieval of the umbilical cable is accomplished by use of a separate dedicated winch. Cable payout is controlled by a linear cable engine or a drum cable engine.

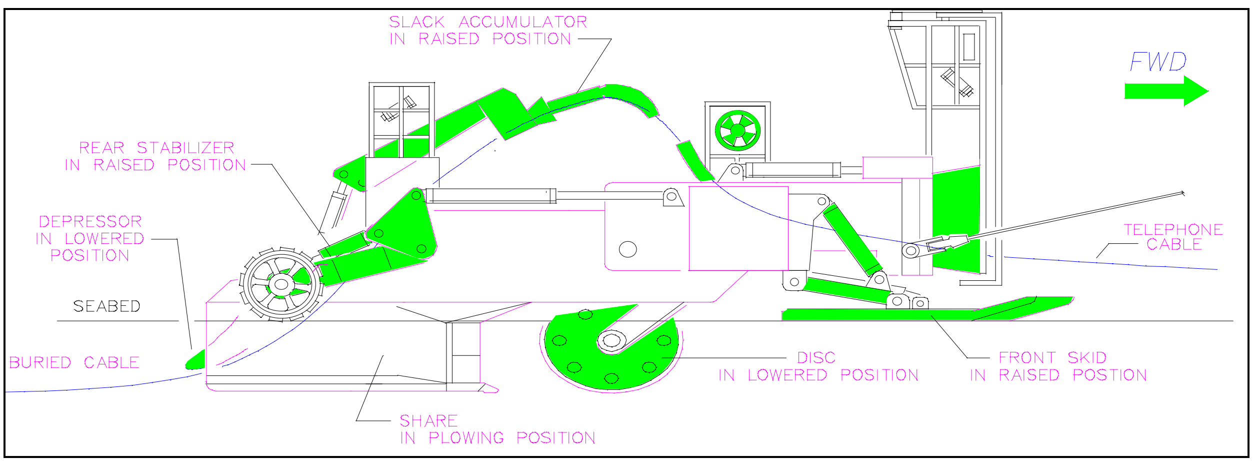
Sea Plow VII is equipped with hydraulically adjusted front skids, adjustable rear wheels and stabilizers, a variable-depth plowshare, an adjustable cutting disc, a steering mechanism, an adjustable slack accumulator, as many as three monochrome video surveillance cameras with lighting, obstacle avoidance sonar, and other electronic sensors and controls. Appendix C contains additional technical detail on the Sea Plow VII.

The total width of the sea plow is 4.6 m including skids and rear stabilizers, which have wheels attached at their ends. The ground bearing of the plow on the sea bed is approximately 400 pounds per square inch (lb/in^2). This is the static load of the plow as it rests on the sea bed based on its submerged weight. This does not include the tow cable tension, which would induce an upward lift on the plow. It also does not consider that uplift of the plow tip or plow share uplift that is generated during plowing operations. The plow is designed such that during plowing, the weight of the plow rests on the plow share to achieve maximum penetration. Thus, the bearing on the sea bed from the plow during installation operations is significantly decreased by these operational factors (360networks, inc. 2000c).

The skids and rear wheels prevent significant disturbance of the sediment and the settlement of the plow into the sediment during the cable laying process. Thus, the net impact of the cable installation process by direct plow technique proposed is the temporary dislocation of a wedge of soil 1.0 m wide at the sea bed surface. Total area of disturbance within the Stellwagen Bank NMS is estimated at 1.0 m wide by 19.5 km long or approximately 4.8 acres of disturbance.

At the beginning of burial operations, the cable is loaded into the sea plow while the sea plow is onboard the cable ship. The sea plow then is lowered to the ocean bottom (with the cable already inside the plow). That operation causes a small section of cable, where the sea plow initiates burial, to be exposed during plow operations. After the cable has been installed, the exposed areas are buried by a remotely-operated vehicle (ROV), such as a submersible craft-assisting repair and burial (SCARAB) vehicle. At the completion of the cable burial operations, the sea plow is retrieved and replaced onboard the cable ship. Figure 2-3 shows some key details in a starboard view of the Sea Plow VII in cable burial mode.

Figure 2-3: Sea Plow VII in Cable Burial Mode (Earth Tech 1999)



To ensure safety during the cable-laying process, a checklist is reviewed, and a project-specific plan is developed. The various operational phases are reviewed, and the possible risks posed by intrusion by pleasure boats and fishing vessels and other commercial traffic are determined. Appropriate security requirements for identifying and warning against or preventing such intrusions are identified. Such security requirements may include notice to mariners, patrol picket boats, aircraft fly-overs, and the placement of warning or marker buoys.

The cable-laying operations would be conducted 24 hours a day. The officers and crew of the cable ship routinely would take actions appropriate to the prevailing circumstances and conditions to conduct safe operations at all times (day or night) and in all kinds of weather. Cable operations would cease if a safe operation could not be achieved. Therefore, no increased risks resulting from nighttime operations are anticipated.

Installation of the cable could be temporarily halted when sea conditions are unfavorable, without severing the cable. However, modern cable ships can hold position under the most extreme weather conditions so that abandonment and retrieval of cable does not become necessary (360networks, inc. 2000a).

Operation and Maintenance

Once the cable has been placed in service, operation of the cable would not likely require any marine activity, by ships, submersibles, or divers. Maintenance of the cable, other than that necessary to repair direct damage to it, would not require marine activities.

The assumption of fault rates by the applicant's maintenance providers for the entire 12,124 km Hibernia Project is from 1.58 to 2.58 faults per year. Use of the high-end figure yields an expected number of approximately 0.005 faults along the cable segment that lies within the Stellwagen Bank NMS, or one fault every 200 years (360networks, inc. 2000a). The primary threat to submarine cables is bottom fishing; the fault rate considers both buried and unburied cables, although historically the majority of faults affect unburied cable. Therefore, the applicant considers the quoted fault rate for the Stellwagen Bank NMS to be a conservative estimate (360networks, inc. 2000b). Appendix D provides excerpts from a technical paper that describes in detail threats to submarine cables.

In the unlikely event of a fault in the system (damage to the cable) within Stellwagen Bank NMS, a cable repair ship would proceed to the repair site, and a low-frequency tone would be applied to the cable to assist in locating it. The ship then would deploy a remotely operated vehicle (ROV), such as the SCARAB. The SCARAB is used to unbury the cable, assist in retrieving the cable from the ocean floor, and to rebury the cable after the repair has been completed. During repair operations, the SCARAB is tethered by an umbilical cable to a vessel, upon which the supporting equipment is mounted. Such support equipment include an articulating crane, used for launch and recovery; a control console enclosed in a control van; portable power generators and hydraulic power units; a maintenance van that contains maintenance tools and spare parts; and a cable storage winch for the umbilical cable (Earth Tech 1999).

The amount of cable that would need to be unburied in the event of a repair is approximately three times the water depth in the vicinity of the repair. During the process of unburying the cable, the ROV would typically displace approximately 3 inches of sea bed around the cable. After the cable is unburied, it would be pulled up to the surface using the cable handling equipment on the cable ship. In the event of a cable break, both ends would be brought to the surface. The scrap-tag end would be recovered by the cable ship and the actual fault would be cut off and labeled. The cut ends would be tested, and when the tests have been completed and a fault-free cable re-established, the cable ends would be sealed and buoyed off for later recovery. The amount of cable to be removed from the line during a repair would be calculated with an added 1 km for contingencies. This approximately 1 km loop of cable would be reburied upon repair completion. The repair cable would be spliced to one of the existing cable ends. When the initial splice has been completed and tested, the repair cable would be paid out toward the other cable-end recovery buoy, which would be recovered and brought to the splicing area on board. The repair cable then would be cut to length and spliced to the existing cable. Upon satisfactory completion of tests, the final splice would be lowered to the sea bed and cut away. The ROV would then bury the repaired cable (360networks, inc. 2000d).

Replacement of a damaged repeater would be accomplished as described above. The existing cable would be cut, and both ends brought to the surface. A new repeater and repair cable would be spliced to one of the existing ends and lowered to the sea bed. The repair cable then would be buried by an ROV such as the SCARAB. As stated earlier, no repeaters would be located within the Stellwagen Bank NMS (360networks, inc. 2000a and Earth Tech 1999).

Cable Life-Cycle

The life expectancy of the cable is 25 years. Conventionally, cables are abandoned and left on the sea bed at the end of their lifespan. Because the cable segment crossing Stellwagen Bank NMS would be buried, there is little chance that it would become uncovered during its lifespan. Leaving the cable in place would avoid any environmental effects associated with its removal. Possible future plans for the cable may include donation of the cable to the scientific community to be used for monitoring of the sea bed (Earth Tech 1999). An alternative approach would be to remove the cable at the end of its estimated life expectancy. Doing so would entail effects on recolonized benthic communities along the cable route.

2.2.2 Northern Alternative

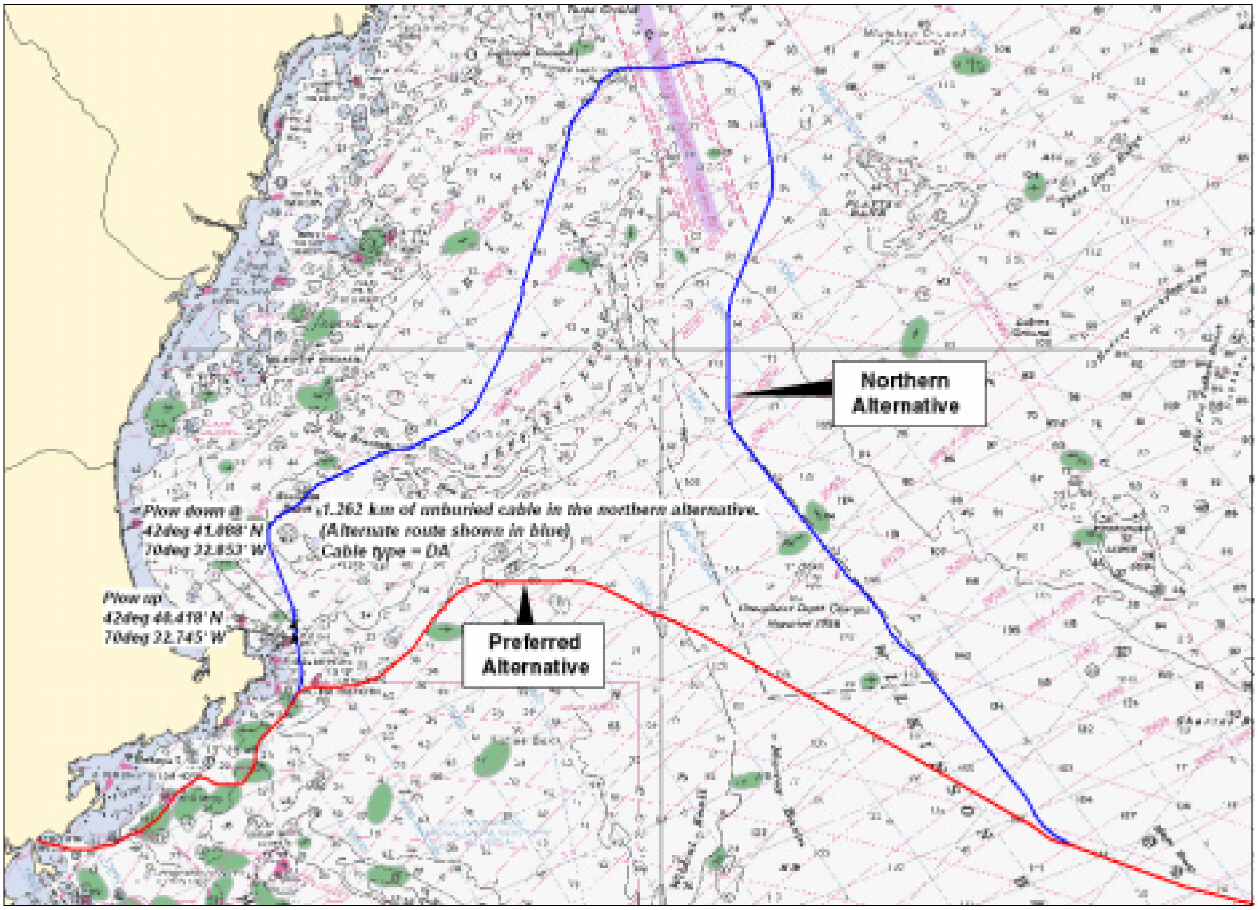
For the Northern Alternative cable route, installation and operations and maintenance activities would be expected to be almost identical to those for the Preferred Alternative. Accordingly, this section discusses only those activities or materials that differ from those discussed in Section 2.2.1.

Cable Route

The Northern Alternative has been identified as an alternative cable route that would avoid the Stellwagen Bank NMS. The alternative deviates from the Preferred Alternative at Wilkinson Basin, well to the east of the sanctuary. From that point, the route proceeds north-northeast avoiding the sanctuary and Jeffrey's Ledge, a geologic formation with features that include sands and gravels, rocks, rock ledges, and steep slopes (Drew 1999, cited in Earth Tech 1999). North of Jeffrey's Ledge the route turns to the west, then to the south-southwest, staying to the west of the ledge, passing between Old Scantum and New Scantum Banks and rejoining the Preferred Alternative route approximately 2 mi off the coast of Cape Ann, MA (Earth Tech 1999). The length of the Northern Alternative route from the point at which it diverges to the point at which it rejoins the Preferred Alternative would be approximately 219.9 km (see Figure ES-1) (Seafloor Surveys International, Inc. 1999).

Detailed ocean surveys of the Northern Alternative have confirmed that along portions of the route, burial of the cable is not possible because of geologic conditions. Figure 2-4 is a map of the Northern Alternative cable route, indicating segments that would be unburied (360networks, inc. 2000c). Three main areas of concern indicate that full burial of the cable would not be possible. The first area of concern is located at the west edge of the southern margin of Jeffrey's Ledge. A granite headland outcrop continues seaward across the area surveyed. Data from side-scan sonar and subbottom profiling indicate that the granite continues to the east. The existence of only a limited, discontinuous, thin veneer of sediments would force surface-laying of the cable over that bedrock area. Bedrock continues until it reaches Jeffrey's Ledge. A 6.5 km perpendicular development line was run northeast across the survey area in an attempt to define the extent of the bedrock. The effort proved unsuccessful, since there were no breaks in the bedrock that might allow burial of a cable.

Figure 2-4: Northern Alternative Cable Route (360networks, inc. 2000a)



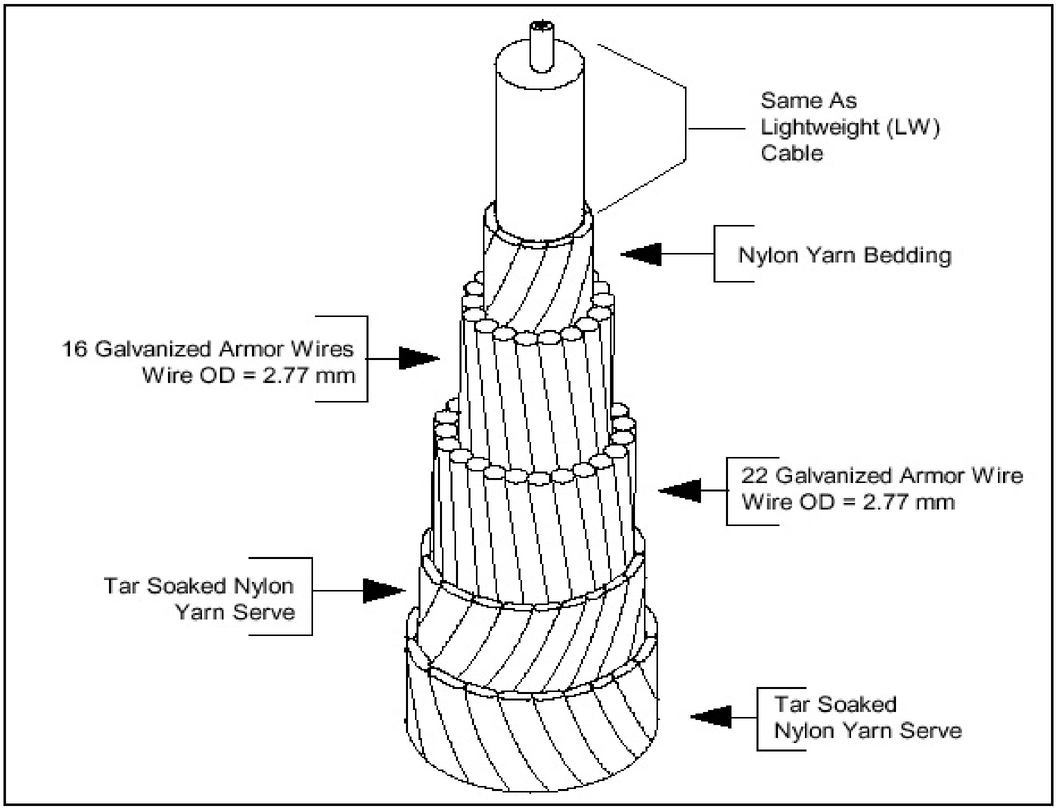
Farther north along the route, a small crevasse was surveyed. The area is bounded on both sides by large outcrops of granite bedrock. The area was surveyed extensively in search of a more benign route. Although a 3 km swath was conducted, no such route was found. Another concern related to the area is the speed of the currents that travel through the crevasse. The current could cause cable strumming or removal of sediment from the area that could jeopardize the integrity of the cable.

The northern portion of Jeffrey's Ledge is composed of large areas of granite outcrops and sharp granite ridges. To avoid these outcrops, a new survey route was identified 5 km south of the original route, but still north of Jeffrey's Ledge. The new route did prove more hospitable, with less frequent outcrops of granite. The area remains a concern related to installation because of the proximity of the cable route to the outcrops. Therefore, selection of the Northern Alternative would require that certain portions of the cable be installed along the seafloor (approximately 1.262 km), rather than buried (Earth Tech 1999).

Cable Characteristics

Should the Northern Alternative route be chosen, the technical specifications for the proposed cable would differ slightly than those for the Preferred Alternative. If a fiber-optic cable is to be laid on the sea floor without burial, additional armoring of the cable is necessary to lessen the potential for accidental breaks in the cable that could occur. Figure 2-5 shows the more heavily armored cable that would be used if the Northern Alternative cable route were selected. The cable for the Northern Alternative contains extra layering or armoring to protect against possible damage along the segment that would not be buried.

Figure 2-5: Armored Cable Cross-Section (360networks, inc. 2000a)



Cable Installation

For the Northern Alternative, approximately 104.6 km of additional cable would be required, compared with the Preferred Alternative route (Seafloor Surveys International, Inc. 1999). Other than the greater length of cable to be installed (and therefore more sea bed area to be affected), the installation procedures would be identical to those described for the Preferred Alternative, except as noted below. Detailed marine surveys indicate that burial of the cable would not be possible along certain portions of the Northern Alternative route because it would be necessary to cross rock. It is anticipated that approximately 1.262 km of the cable would be unburied because of unfavorable sea bed conditions (360networks, inc. 2000c).

For installation of unburied cable, the cable ship would follow a charted course for the project, paying out cable as it proceeds. As the cable is paid out, sufficient slack is maintained to ensure that the cable is placed along the ocean floor with no tension and no suspensions. The armored cable is allowed to sink at a controlled rate into its desired position. Installation of unburied armored cable generally proceeds at a rate of 2 knots.

Operation and Maintenance

Based on studies of other cable systems, those with no burial or shallow burial have higher rates of breaks and subsequent repairs than buried cable systems. However, operations and maintenance activities (and the likelihood of the need for maintenance) would be essentially the same as those described for the Preferred Alternative route because of the very short segment that would be unburied.

Location of the cable would be marked on marine charts, and unburied segments would be noted (360networks, inc. 2000b).

Cable Life-Cycle

For the Northern Alternative route, the life-cycle of the cable would be identical to that described for the Preferred Alternative route.

2.2.3 No Action Alternative

Under the No Action Alternative, the proposed undersea fiber-optic cable would not be installed. No operations and maintenance activities would occur. This alternative would not fulfill the purpose of the project or meet the identified needs for high-speed data transmission. It therefore would be necessary to consider alternative methods of meeting data transmission requirements.

2.2.4 Alternatives Considered But Not Carried Forward for Analysis

The applicant evaluated a number of alternative approaches and cable routes that either did not fulfill the purpose of the project or did not meet the criteria set forth in Section 2.1. The major factors that affected the acceptability of those options were potentially adverse environmental effects, unstable shorelines, and problems related to technical feasibility.

All-Land-Based Route

An entirely land-based route for the length of the cable between the Boston area and Nova Scotia was evaluated. An all-land-based route was determined to be substantially more expensive, more prone to failure, and likely a cause of greater environmental effects than a submarine cable. Some portions of a land-based route might require installation on poles, an approach that is far less reliable than a submarine installation, because of vulnerability to weather conditions. Selection of an entirely underground route would require new rights-of-way and considerable temporary ground disturbance. For those reasons, the option was ruled out as an alternative for consideration in this EA (Earth Tech 2000a).

Southern Avoidance Route

The applicant evaluated a southern alternative route that would bypass the Stellwagen Bank NMS. The route would allow for only 3.7 mi between the Cape Cod shoreline and the southern border of Stellwagen Bank NMS. Because of proximity to potentially unstable banks, the route was considered to increase risks to the integrity of the cable as a result of potential sediment slumps. Environmental considerations also made the option unacceptable. The southern alternative route would transit critical habitat for the endangered northern right whale and would entail entanglement risks during installation. The southern alternative route also would require a landing site other than the Lynn Beach site and would pass through key lobster fisheries. For those reasons, the option did not meet the criteria of minimizing environmental impacts and minimizing threats to the integrity of the cable (Earth Tech 2000a).

Northern Avoidance Route

The applicant evaluated the possibility of routing the cable just north of the boundary of the Stellwagen Bank NMS. Extensive surveys performed in that area determined that the sea bed in the area is unsuitable for installation of cable because of the geologic feature known as Jeffrey's Ledge. Prevalent rock outcroppings in the area would put the cable at high risk of damage from strain. Burial of the cable would not be possible in a large portion of this route, and stable installation along the sea bed also is unlikely because of the geologic features of the area. In addition, the area is fished and trawled more heavily than the routes considered for the Preferred Alternative or that for the Northern Alternative that avoids the Jeffrey's Ledge area. The applicant determined that those characteristics would decrease dramatically the technical feasibility of installing cable along the route (Earth Tech 2000a).

Nonburial Option

The applicant considered a nonburial option that would consist of laying cable along the Preferred Alternative route. Under that option, in waters deeper than 75 feet, the cable simply would be laid on the ocean bottom, rather than buried. To prevent damage by fishermen, the location of the cable would be charted as a restricted area in which dragging would be prohibited. Even given such precautions, unburied installation would leave both the cable and fishing gear more vulnerable to damage. For those reasons, the nonburial option was ruled out (Earth Tech 1999).

Satellite Data Transmission

The applicant evaluated a noncable option of replacing the proposed telecommunication and data transmission services with satellite communications. The use of communications satellites to provide the services identified as necessary would require no construction in the marine environment, but would not provide the capacity or quality of service proposed under the Hibernia project. The option does not meet the purpose of the project and therefore is not discussed in detail. In summary, the applicant determined that it would require more than 1,000 typical communications satellites to provide the same capacity as that proposed under the Hibernia Project. For the project's stated purpose and need, fiber-optic cables also are the only technology that can provide the desired capacity, transmission quality (as measured by bit error rate), and transmission delay required for modern data networks, including the Internet and corporate data networks.